

**C. Mr. MacLavery Fails to Support his Arguments with Reliable Empirical Analysis**

127. As noted above, Mr. MacLavery simply compares DRW's bids to the Corresponding Rates (and to earlier periods when the IDCG settlement prices only included reference to the Corresponding Rates since no traders were bidding during the Settlement Period). Below, I critique this comparison on multiple levels.

128. Firstly, Mr. MacLavery fails to conduct a meaningful valuation analysis of the Three Month Contract. He simply repeats the obvious fact that prices quoted by DRW during the Settlement Period differed from the Corresponding Rates. Secondly, his report repeatedly and erroneously refers to the "potential" for the convexity effect.<sup>104</sup> The NPV and convexity effects are real and impacted the value of the Three Month Contract regardless of whether the contract was settled at fair value or the Corresponding Rates. Thirdly, Mr. MacLavery's assertions are made without any meaningful attempt to quantify the value of the NPV and convexity effects that existed during the time in question. I have taken the care to estimate those values in Section VIII of this report and found that DRW's bids are all well within reasonable price ranges that might be expected given market conditions at the time.<sup>105</sup>

**D. Mr. MacLavery's Statements Regarding "Potential" Convexity Effect Are Incorrect and Unsupported**

129. Mr. MacLavery's report demonstrates his lack of understanding of how the NPV and convexity effects affect cleared interest rate futures markets. He does not provide any definition of the convexity effect, nor does he discuss the magnitude of, sources of, or

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<sup>104</sup> MacLavery Report ¶7 and ¶54.

<sup>105</sup> See Section VIII where I explain how I calibrated the Hull-White model using publicly available data on short- and long-term interest rates and prices of interest rate swaptions during the Relevant Period.

results from the convexity effect. Mr. MacLavery also does not address the NPV effect in his report.

130. Further, he fails to recognize that the NPV and convexity effects are not some hypothetical or potential market outcome, but rather are the result of interest lost or gained on payments made via variation margin accounts, a structural outcome from margining processes. It is a real and accepted process in various other markets that other exchanges (like LCH.Clearnet) address in their clearing rules.
131. Mr. MacLavery's claims that DRW allegedly profited from a "potential convexity bias" reflect a complete misunderstanding of the NPV and convexity effects. As noted above, the interest lost or gained on payments made via the variation margin accounts creates a structural reason that cleared futures contracts (like the Three Month Contract) deviate in value from their non-cleared OTC interest rate swap counterparts. As shown in Section VII, the convexity effect has been known to exist back to at least 1994 when Burghardt and Hoskins published "The Convexity Bias in Eurodollar Futures."<sup>106</sup>
132. The CFTC further muddles the subject when discussing "at least two pre-conditions" for the convexity effect to exist. The CFTC wrongly asserts that the convexity effect depends on two pre-conditions: "(a) market knowledge of the benefit accruing to those paying fixed rates in an interest rate contract; and (b) collective action by the shorts demanding higher rates in compensation."<sup>107</sup> No such "pre-conditions" exist and indeed are nowhere found in models of the convexity effect.

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<sup>106</sup> Burghardt, Galen, and Hoskins, William (1994), "The Convexity Bias in Eurodollar Futures," Dean Witter Institutional Futures Research Note.

<sup>107</sup> Complaint ¶22.

133. Rather, a properly functioning market should either account specifically for the NPV and convexity effects in the contracts themselves (as do LCH.Clearnet and the CME Group through the PAI) or should incorporate the impact of these effects on value into settlement prices (as DRW's bids did). The CFTC's assertion that "a collective action by the shorts demanding higher rates in compensation" is required only serves to bolster DRW's defense. No short directly took the opposite side of DRW's bid, suggesting that the "collective action" was only to withhold trades because *the compensation offered by DRW was not high enough (not far enough away from the Corresponding Rates)*. In this light, DRW's bids, rather than being artificially high, could easily be interpreted as still being below-market, despite the fact that they were higher than the Corresponding Rates. In the face of this market evidence, and the NPV and convexity effects in general, it would have been "artificial" for IDCH to ignore DRW's bids and continue to default to the Corresponding Rates.
134. Given that the NPV and convexity effects are determined structurally by the exchange of variation margins on cleared instruments and collateral on non-cleared instruments, respectively, these effects can be counteracted directly, with PAI, for instance. In the absence of a formal PAI or any other adjustment feature, market prices are likely to exist naturally within a range of prices between the non-cleared OTC interest rate swap price and an unknown, but higher cleared futures contract price. The width of this band will thus be determined by the changing correlation structure between interest rates and interest rate swaps (and the duration of the contract if correlations change differentially across the term structure) and the volatility of interest rates (which affects the relative difference between margins and collateral).



**E. Mr. MacLavery's Statements Regarding Price Discovery Are Wrong and Unsubstantiated**

135. Mr. MacLavery states that DRW's bids did not aide in price discovery or add liquidity to the Three Month Contract.<sup>108</sup> These statements are erroneous. Rather, DRW's bids served an essential role in the price discovery process for the Three Month Contract, as described in Section X. Similarly, Mr. MacLavery ignores the fact that exchanges and clearinghouses, such as IDCH, have strong incentives for price discovery to take place in their venues and encourage traders, including DRW, to participate in price discovery by posting quotes.

**XIII. CONCLUSIONS**

136. Having analyzed the materials set forth in Appendix C and conducted the analysis described herein, there is no support for the CFTC's allegations that DRW manipulated or attempted to manipulate the market, "unlawfully placed orders for certain futures contracts with the intent to move the prices of the contracts in their favor, to increase the value of the futures contract positions they held in their portfolio," or employed any illegal or manipulative scheme to create artificial prices.<sup>109</sup> To the contrary, DRW's bids in the Three Month Contract were based on proprietary valuation methods, which I have confirmed comport to my own estimates of value for the Three Month Contract. Moreover, DRW's bids were legitimate offers to purchase the security, posted at higher, more attractive rates (to sellers) than the Corresponding Rates, and did not therefore represent "artificial prices" as alleged.

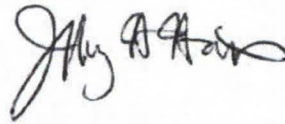
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<sup>108</sup> MacLavery Report, ¶75.

<sup>109</sup> Complaint ¶1.

137. DRW's bids on the Three Month Contract reflected the NPV and convexity effects and therefore represent a clear example of proprietary pricing methods contributing to price discovery in the Three Month Contract, at prices more closely representative of true supply or demand for the Three Month Contract than the Corresponding Rates.
138. The NPV and convexity effects affected the value of DRW's open positions regardless of whether IDCH settled the Three Month Contract to prices that reflected DRW's bids or to the Corresponding Rates. DRW profits stemmed from the fact that DRW entered into a long position on the Three Month Contract at prices substantially below the Three Month Contract's fair value.

Executed on July 27, 2015

A handwritten signature in black ink, appearing to read "Jeffrey H. Harris". The signature is fluid and cursive, with the first name "Jeffrey" being more prominent.

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Jeffrey H. Harris, Ph.D.

**Exhibit 1****Characteristics of the Three Month Contract**

<b>Three Month Contract</b>	IDEX USD Interest Rate Swap Futures Contract.
<b>Exchange</b>	NASDAQ OMX Futures Exchange.
<b>Clearinghouse</b>	International Derivatives Clearinghouse, LLC.
<b>Settlement</b>	Cash settled.
<b>Schedule</b>	The Exchange at any given time may list for trading the Three Month Contract having maturities from one day to thirty years, with a contract maturing on every calendar day. The Maturity Date of each individual Three Month Contract shall be established by the Exchange on the date each such contract is listed by the Exchange.
<b>Daily Settlement Price</b>	Each open position is valued by the Clearinghouse at the end of each trading day by valuing each leg of the cash flows of the contract (fixed and floating) according to discount factors generated by the IDEX Curve. Each Trading Day, the Daily Settlement Price shall be established by the Clearinghouse based upon the IDEX Curve that corresponds to the fixed rate portion of the swap. A net present value of the position will be determined and set as the Daily Settlement Price. Notwithstanding the preceding sentence, the Clearinghouse may, in its sole discretion, establish a Daily Settlement Price that is a fair and appropriate reflection of the market. The Final Settlement Price shall be the Daily Settlement Price on the Last Trading Day.
<b>Effective Date</b>	2 week days after execution of any individual Three Month Contract, adjusted by the Following Business Day <sup>[1]</sup> convention for New York.
<b>Maturity Date</b>	Final payment date, unadjusted by any Business Day convention, of the Three Month Contract and shall be established by the Exchange on the listing date.
<b>Payment Schedule</b>	Periodic payments on semi-annual basis for the fixed rate payments and on quarterly basis for the floating rate payments. Each payment date will be defined by the Effective Date, the Maturity Date, and the payment frequency of the fixed or floating side, adjusted by the Modified Following Business Day convention for New York and London.
<b>Floating Rate Payment</b>	$(\text{Notional Value}) \times (\text{USD LIBOR}^{[2]}) \times (\text{Actual} / (360 \text{ Accrual Year Fraction}))^{[3]}$
<b>Fixed Rate Payment</b>	$(\text{Notional Value}) \times (\text{Fixed Rate}) \times (30 / (360 \text{ Accrual Year Fraction}))^{[4]}$
<b>Minimum Price Increments</b>	0.001 percent of the fixed leg portion of the Swap.
<b>Last Trading Day</b>	Last Day on which the Exchange is open for the trading of the Three Month Contract preceding the contract's Maturity Date.

**Notes:**

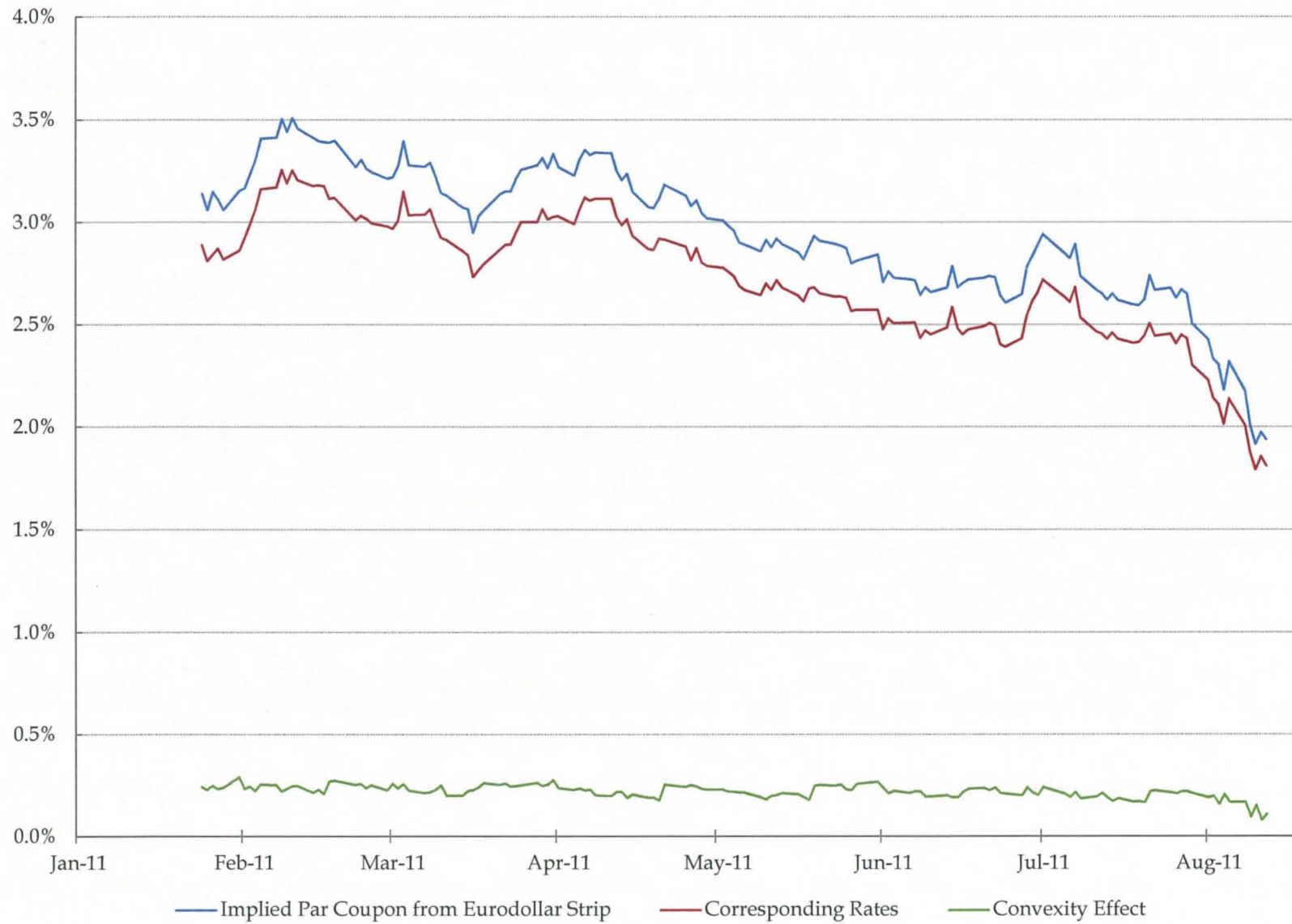
- [1] Following Business Day Convention means the date will be adjusted to be the first following day that is a Business Day in the locations listed.
- [2] USD 3-month LIBOR rate.
- [3]  $(\text{Actual} / (360 \text{ Accrual Year Fraction}))$  means the actual number of days in the interest period in respect of which payment is being made divided by 360.
- [4]  $(30 / (360 \text{ Accrual Year Fraction}))$  means the number of days in the interest period in respect of which payment is being made (assuming 30 day months) divided by 360, calculated on a formula basis as follows;  

$$[(360 \times (Y2 - Y1)) + [30 \times (M2 - M1)] + (D2 - D1)] / 360,$$
where:  
Y1 is the year, expressed as a number, in which the start date of the interest period falls.  
Y2 is the year, expressed as a number, in which the end date of the interest period falls.  
M1 is the calendar month, expressed as a number, in which the start date of the interest period falls.  
M2 is the calendar month, expressed as a number, in which the end date of the interest period falls.  
D1 is the first calendar day expressed as a number, of the interest period, unless such a number would be 31, in which case D1 will be 30.  
D2 is the last calendar day, expressed as a number, of the interest period, unless such a number would be 31 and D1 is greater than 29, in which case D2 will be 30.  
The start date of the n<sup>th</sup> interest accrual period is the Effective Date plus  $(n-1) \times (\text{payment frequency of the fixed or floating side as appropriate})$ , adjusted by the Modified Following Business Day convention for New York and London.

**Sources:**

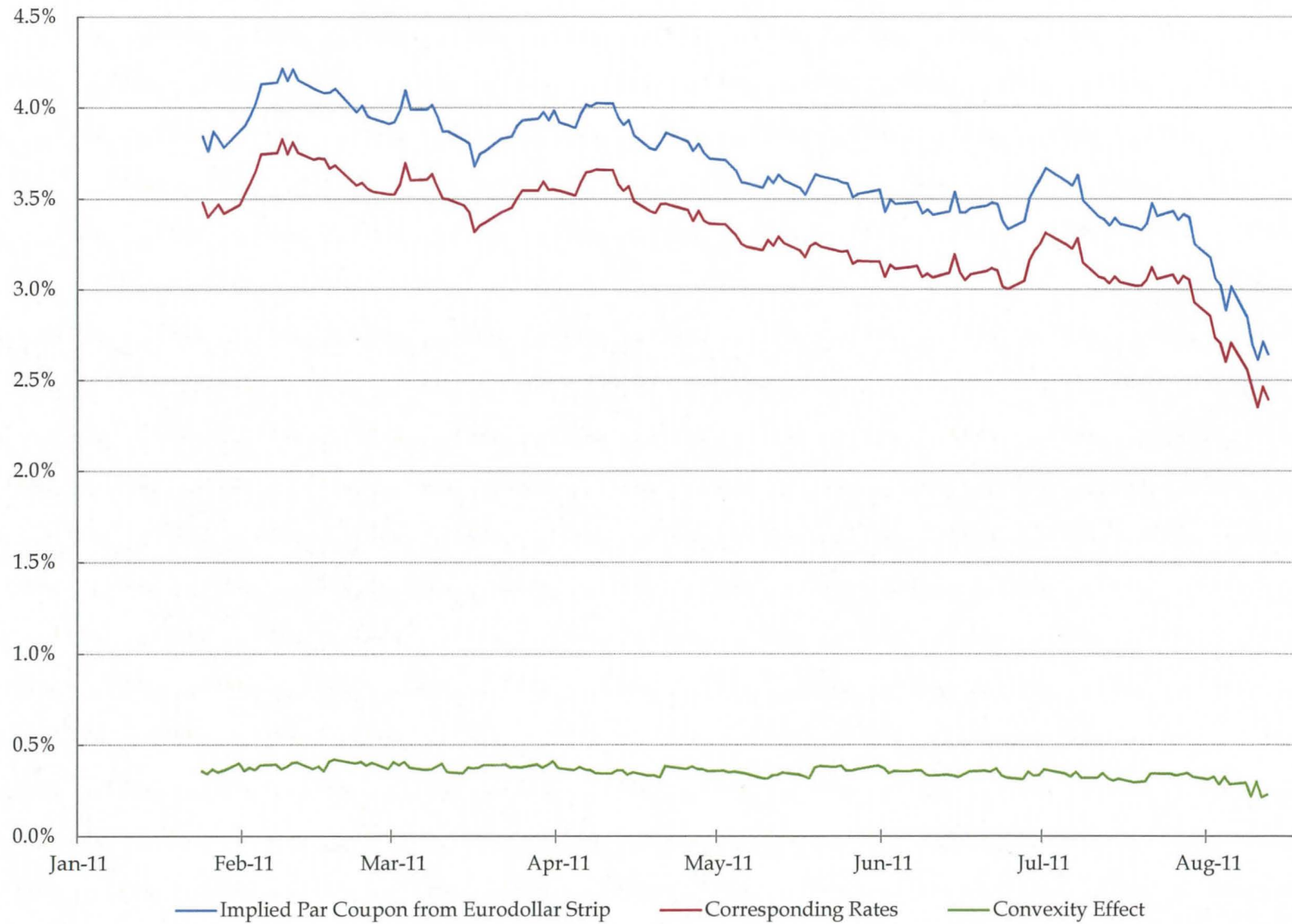
- [1] IDCg IDEX USD Interest Rate Swap Futures Contract Specifications. Available at:  
[http://www.idcg.com/pdfs/IRSF\\_ContractSpecification.pdf](http://www.idcg.com/pdfs/IRSF_ContractSpecification.pdf).
- [2] Rules of International Derivatives Clearinghouse, LLC, As of September 1, 2010, p. 100.

**Exhibit 2A**  
**Eurodollar Futures Implied Convexity Effect Relative to 7-Year Swap**





**Exhibit 2B**  
**Eurodollar Futures Implied Convexity Effect Relative to 10-Year Swap**





**Exhibit 2**  
**Eurodollar Futures Implied Convexity Effect Relative to Swap Rates**

**Notes:**

- [1] Implied Par Coupon from Eurodollar Strip is obtained from par yield curve based on Eurodollar Futures contracts.
- [2] Corresponding Rates are obtained from IDCG. See DRW-IDCG-0000003.xls and Deposition of Garry O'Connor, pp. 211-21, JEF-CFTC472883-85.
- [3] Convexity Effect represents the difference between the Implied Par Coupon and the Corresponding Rates.
- [4] According to the Complaint, DRW entered bids on the Three Month Contract between January 24, 2011 and August 12, 2011.

**Sources:**

- [1] Deposition of Garry O'Connor, September 18, 2012, JEF-CFTC-472831-920 and Exhibit 74 to the Deposition of Garry O'Connor, JEF-CFTC-474132.
- [2] DRW-IDCG-0000003.xlsx
- [3] Bloomberg, L.P.
- [4] Complaint ¶¶ 3, 40.

**Exhibit 3A**  
**Difference of DRW's Bids and Corresponding Rates and Hull-White NPV and Convexity Effects**  
**7-Year Maturity**



**Exhibit 3B**  
**Difference of DRW's Bids and Corresponding Rates and Hull-White NPV and Convexity Effects**  
**10-Year Maturity**

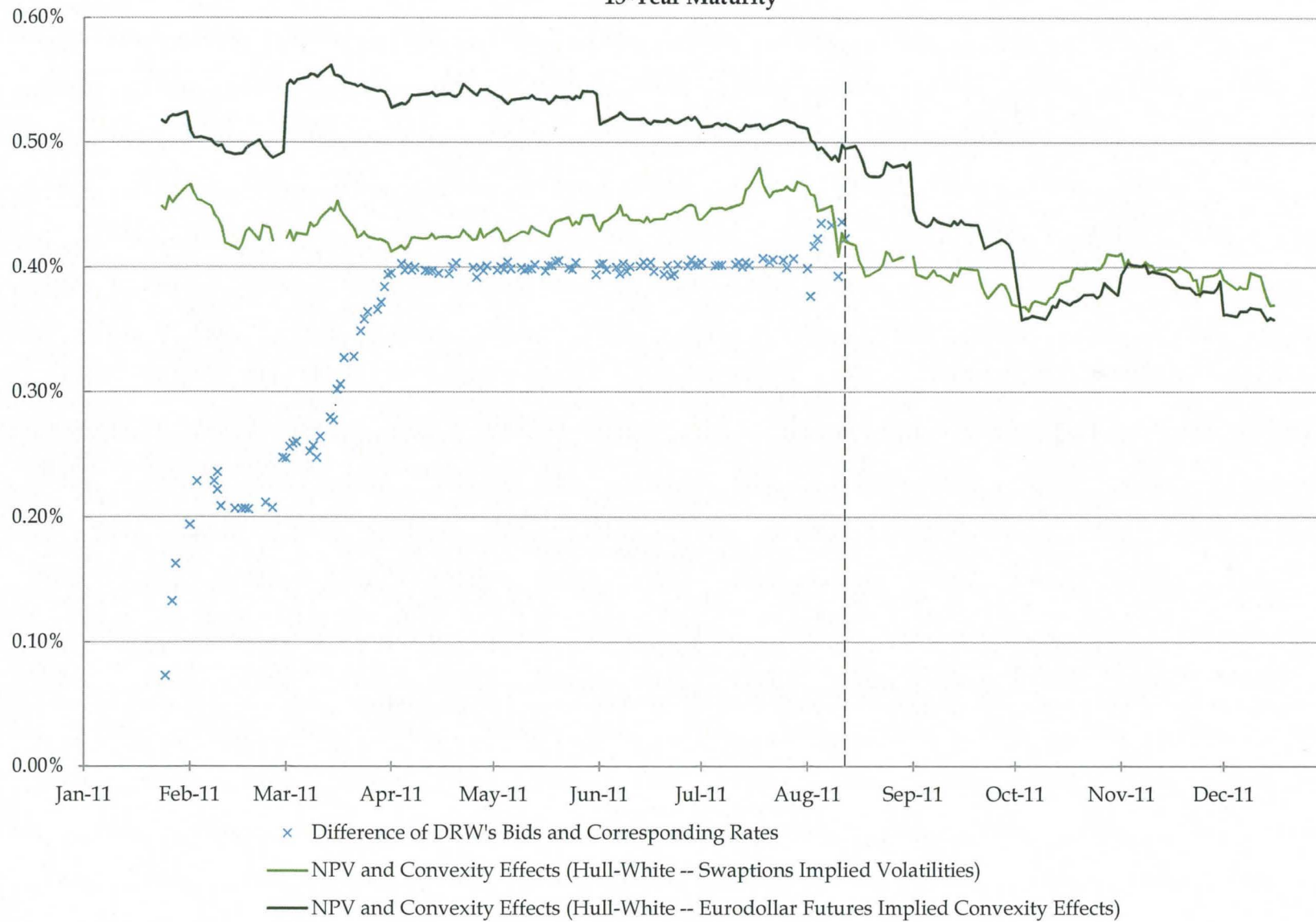


**Exhibit 3C**  
**Difference of DRW's Bids and Corresponding Rates and Hull-White NPV and Convexity Effects**  
**12-Year Maturity**

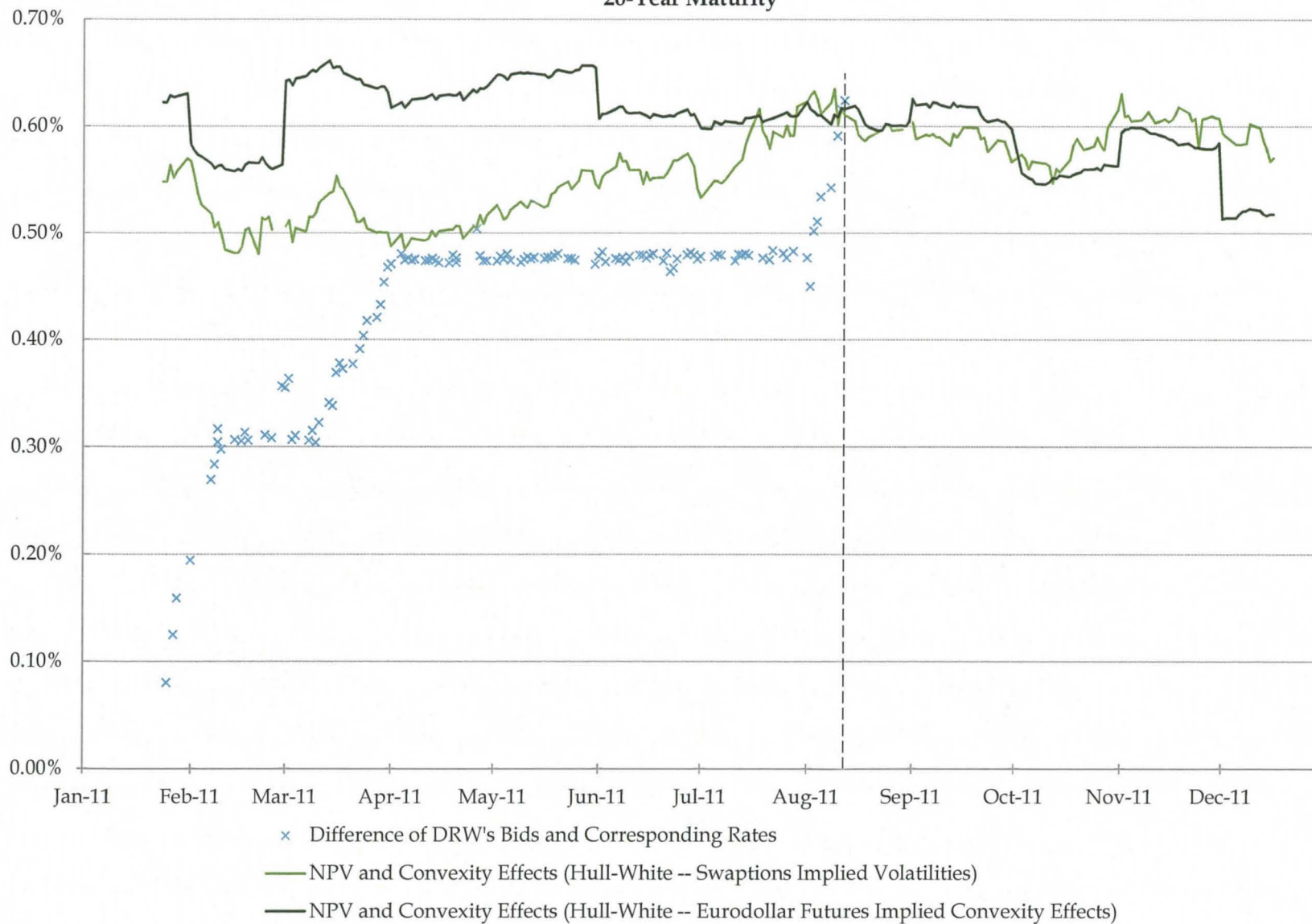




**Exhibit 3D**  
**Difference of DRW's Bids and Corresponding Rates and Hull-White NPV and Convexity Effects**  
**15-Year Maturity**



**Exhibit 3E**  
**Difference of DRW's Bids and Corresponding Rates and Hull-White NPV and Convexity Effects**  
**20-Year Maturity**



**Exhibit 3F**  
**Difference of DRW's Bids and Corresponding Rates and Hull-White NPV and Convexity Effects**  
**25-Year Maturity**



**Exhibit 3G**  
**Difference of DRW's Bids and Corresponding Rates and Hull-White NPV and Convexity Effects**  
**30-Year Maturity**





**Exhibit 3**

**Difference of DRW's Bids and Corresponding Rates and Hull-White NPV and Convexity Effects**

**Notes:**

- [1] Difference of DRW's Bids and Corresponding Rates represents the difference between DRW's Bids and the Corresponding Rates.
- [2] Difference of DRW's Bids and Corresponding Rates reflects only those bids placed by DRW during the PM Settlement Period (1:45-2:00 PM CT).
- [3] Difference of DRW's Bids and Corresponding Rates excludes bids not within 0.20% of the IDEX Curve. A total of 19 bids were excluded across all maturities.
- [4] Corresponding Rates are obtained from IDCG. See DRW-IDCG-0000003.xlsx and Deposition of Garry O'Connor, pp. 211-21, JEF-CFTC472883-85.

**Sources:**

- [1] Deposition of Garry O'Connor, September 18, 2012, JEF-CFTC-472831-920 and Exhibit 74 to the Deposition of Garry O'Connor, JEF-CFTC-474132.
- [2] DRW-IDCG-0000001.xlsx
- [3] DRW-IDCG-0000003.xlsx
- [4] Brian Vander Luitgaren IDCH Activity Logs Produced by DRW on December 14, 2011 and February 6, 2012.
- [5] Bloomberg, L.P.